

SYSTEM FOR LIFTING AND MOVING AN OBJECT

CLAIM OF PRIORITY

5 This application claims priority under 35 USC § 119(e) to U.S. Patent Application Serial No.60/268,300, filed on February 13, 2001, the entire contents of which are hereby incorporated by reference.

Technical Field

10 The invention relates to apparatuses for lifting objects and displacing them] {System to lift and move an object} from one location to {another, composed of,} [the other.]

15 {- a partially hollow vertical post, equipped at its base with a rotating system using the post as its vertical axis and ensuring its solidity with the help of a support which could be the soil itself;} [Background Art]

20 {- a lateral arm firmly held to the vertical post by a pivot and equipped with a rail on which a carriage moves;} [Many apparatuses for lifting and moving objects from one location to the other are known. Various apparatuses used to lift object and displace them from one location to the other using lateral arms and counter weights are known. See for example Japanese Patent Application of Motoda published under no. 06126664. Other known apparatuses used hydraulic or pneumatic pistons connected to lateral arms using pulleys. See for example US Patents 536,399 (Sawers), 560,125 (Falkenau et al.), 700,162 (Wiley), 2,446,488 (Pierce), 2,476,192 (Hall), 2,562,066 (Scott et al.), PCT Application no. WO98/15487 (Vestin), European Patent Application published under no. 0 254 840 (Gebauer), German Patent 30 02 577 (Shrouder et al.), German Patent 29 18 010 (Häring), Russian Patent 1,781,156 and French published application no. 2,764,591 (Foillard et al.). However, they are cumbersome to use and costly to manufacture.]

30 {- one or many supporting arms firmly held to the vertical post used as a support to the lateral arm; and

~~-a holding system for an object held by a cable to the lateral arm's carriage.~~

~~Characterized by means of:~~

5 ~~-a lateral arm firmly held to the vertical post in ways that allow movement in any pattern passing by the axis of the post;~~

10 ~~-the vertical post equipped inside with a piston moving up and down, preferably under pressure created by a fluid, either liquid, gaseous or granular and preferably within such element as air, inert gases, synthetic or natural oil, mercury, water or sand;~~

~~-the aforementioned piston being held by a cable to the carriage moving in or on the lateral arm's rail and with the object's holding system; and~~

15 ~~-the carriage, preferably equipped with a pulley system, which would allow its movement along the lateral arm and forcing the holding system to remain at the same distance from the carriage no matter its position on the arm.~~

~~The equipment consist of a 12 foot rail (9) fastened to the top of an 8 to 12 foot high, 8 inch diameter post (2)~~

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~~The rail fastening is on a rotating joint (12-21-22-23-24) whichs allows continuous movement at 360 degrees..~~

25 ~~A hole in the rotating joint allows the free movement of a cable (29) while the counterweight rises or lowers.~~

~~The rail (9) is supported by two 1-inch square braces (26) bolted (28) to a rolling block (27).~~

30 ~~The rolling block (27) can move up and down on the outside of the post (2) with the help of two bearings (12).~~

5 A small carriage (10-11-12-13-14-15-16) installed inside the rail (9) allows the load to move freely along the rail.

10 At the end of the rail (9), is capped (19) to close the opening and hold the end of the cable (29) in place.

15 The bottom of the post (2) is welded to a triangular base (1) anchored (3-4) to the floor at each angle and filled with epoxy.

20 Two plastic rings (6) installed on top and bottom of the counterweight (5) prevent friction between metal parts. They are adjusted to let air or other gasses leak at a preset volume, depending on the requirement.

25 A valve installed at the bottom of the post allows the control of air intake used to lift the counterweight.

DESCRIPTION OF THE EQUIPMENT

30 A piece of rubber (7) bolted (8) to the bottom of the counterweight climates impacts when lowering.

35 Two black, high-density steel bands (17) inside the rail (9) smoothen the movement of the carriage (10-11-12-13-14-15-16).

40 A 5/8-inch bearing (15) insures aligning action of the carriage in the rail (9) opening

45 The attachment block (30) prevent cables (29) from falling off the pulley (11) by keeping them under tension.

EQUIPMENT MECHANICAL FUNCTION} [Summary of the Invention]

50 This apparatus has three distinct {functions} [objects]:

- a) Cancel the weight of an object to be lifted by a counterweight;
- b) Allow the operator to lift and lower an object with ease; and

5 c) Move an object with a radius between two to 12 feet at 360 degrees.

~~EQUIPMENT OPERATING PROCEDURES~~ [It is impossible to abuse or break this equipment due to the fact that it can only lift 99% of the counterweight. Friction of mechanical elements is the reason for the 1% loss.]

10 ~~{This equipment is a lifting arm allowing easy handling of any solid object which can be held by a suction disc, a magnet, a hook or any other holding system.} [Using the supporting post as the compression chamber allows 360 degree continuous movement.]~~

15 ~~{The operator can handle the object within a diameter of 24 feet and controls the lifting and lowering by a remote control either wireless or connected;} [The closeness of the pulleys supporting the carriage system produces a breaking effect in the event the operator would try to rise the counterweight too high.]~~

20 ~~{The stand on which the remote control is installed is also used as a handle for the operator at the base of the holding system:~~

~~The holding system can be of any applicable shape.~~

25 ~~Using a melamine-coated sheet as an example, the operator inserts air under the counterweight. As a result, the holding system (in this case the suction disk) lowers on top of the sheet. Once the sheet is appropriately held, he releases the air and the counterweight lowers thus lifting the sheet. The operator can then move the sheet where required and reinsert air to lower it. Finally, he releases the sheet and is ready for another maneuver.~~

30 ~~This equipment is designed to handle small charges varying from 50 to 150 lbs.~~

MAIN CLAIM

System, [The invention relates to a system and apparatus] to lift and move an object from one location to another, composed of:

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{A partially hollow vertical post, equipped at its base with a rotating system using the post as its vertical axis and ensuring its solidity with the help of a support which could be the soil itself;

10 A lateral arm firmly held to the vertical post by a pivot and equipped with a rail on which a carriage moves;

One or many supporting arms firmly held to the vertical post used as a support to the lateral arm; and

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A holding system for an object held by a cable to the lateral arm's carriage.

Characterized by means of:

20 A lateral arm firmly held to the vertical post in ways that allow movement in any pattern passing by the axis of the post;

25 The vertical post equipped inside with a piston moving up and down, preferably under pressure created by a fluid, either liquid, gaseous or granular and preferably within such element as air, inert gases, synthetic or natural oil, mercury, water or sand;

The aforementioned piston being firmly held by a cable to the carriage moving in or on the lateral arm and forcing the holding system to remain at the same distance from the carriage no matter its position on the arm.

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Claims

The principal aspect to be claimed with this invention is "the operation of the counterweight".

†} [a. A partially hollow vertical post;

- b. A counterweight disposed within said post;
- 5 c. First means allowing the counterweight to move vertically;
- d. A lateral arm pivotally held to said vertical post and comprising the first proximal end located near said post and a second distal end located away from said post;
- e. A cable having one end attached to said counterweight and the other end attached to said distal end of the lateral arm;
- 10 f. A carriage supporting said cable;
- g. Second means allowing the longitudinal displacement of the carriage along said lateral arm; and
- h. Means to support said load attached to said cable.

15 **Brief description of the drawings**

Figure 1a is a perspective view of a lifting system in accordance with the invention;

Figure 1b is a top view of the system shown in figure 1a;

Figure 1c is a detailed view of the portion of figure 1a shown in "D";

20 Figure 2 is a detailed view of the portion of figure 3a shown in "B";

Figure 3a is a partial cross-section of the system along line A-A in figure 1b;

Figure 3b is a detailed cross-sectional view of the portion of figure 3a shown in "C";

Figure 3c is a partial cross-sectional side view of the base of the system shown in figure 1a;

Figure 4 is another perspective view of a lifting system in accordance with the invention;

25 Figure 5 is a detailed view of the portion of figure 4 shown in "E";

Figure 6 is another partial view of the portion of figure 4 shown in "E";

Figure 7 is a perspective view of a pulley sub-system for use with a system in accordance with the invention;

30 Figure 8 is another perspective view of a pulley sub-system shown in figure 7 in which a portion of the pulley housing has been removed;

Figure 9 is a perspective view of an arm sub-system for use with a system in accordance with the

invention:

Figure 9b is a perspective view of a base for use with a system in accordance with the invention;
Figure 10 is a perspective view of a cable sub-system for use with a system in accordance with
the invention;

5 Figure 11 is a partial perspective view of a pulley sub-system for use with a system in accordance with the invention;

Figure 12 is another partial perspective view of a pulley sub-system for use with a system in accordance with the invention.

10 **Description of a preferred embodiment**

The apparatus consists in an arm or rail (38) fastened to the top of a post (2). For example, the rail (38) may be 12 foot long steel rail and the post may be a cylindrical steel post having an 8 inch diameter. The height of the post is selected in accordance with the limitation of the work
15 area (for example 8 to 12 feet in height).

A counterweight (5) is disposed inside the hollow post (2) in such a way that it may be raised and lowered within the post. Sealing means (6), such as joints or o-rings, are disposed around the counterweight so as to seal the space between the counterweight and the interior of the post. The
20 sealing means are preferably provided with an opening to allow a predetermined flow of air or gas to pass therethrough.

The rail (38) is fastened to the post (2) with the use of a rotating joint (40) which allows continuous a 360° movement.

25 A hole is provided in the rotating joint (40) to allow the free movement of a cable (29) while the counterweight (5) rises or lowers. As shown in figures 2, 10, 11 and 12, the rotating joint (40) is located in the center of a cover (35) attached to the top of the post (2). Cable (29) passes through a guide (24) and around a pulley (41) which turns around an horizontal axis (20). A
30 bearing (42) is disposed between guide (24) and support cylinder (21) which is fixed to the rail (38) by bolts (23) or other known means. A spacer (22) is disposed between cover (35) and

support (21).

5 The rail (38) is supported by two braces (26) attached by bolts or other known means to a rolling block (27). The rolling block (27) can move laterally on the outside of the post (2) with the help of two bearings (28).

10 A small carriage (50) is installed inside the rail (38) to allow the load to move freely along the rail (38). As illustrated in figures 3b, 7 and 8, the small carriage 50 comprises two pulleys (11) turning around an axis (13) around which is disposed cable (29). A wheel (12) is disposed on each side of the carriage (50). These wheels (12) are placed on rolling surfaces (17), for example a pair of hard steel strips disposed inside the rail (38). A bearing (14) is fixed to a vertical axis (16) to insure the alignment of the carriage within rail (38).

15 One end of cable (29) is attached to counterweight (5). Cable 29 then is wrapped partially around pulley (13). Cable (29) then goes down to an attachment block (30) to which a hook, pince or other means to attach a load is fixed. Cable (29) is then partially wrapped around a pulley within attachment block (30) (see figure 8) before returning to second pulley (11) in the small carriage (50). From there, cable (29) reaches the other end of the rail (38) where it is attached to a cap (19) or other similar means.

20 Attachment block (30) also preferably is used as a weight to ensure that cable (29) is maintained in tension such that it will not easily fall off from pulleys (11) and (13).

25 In the embodiment shown in the figures, the bottom of the post (2) is welded to a triangular base (1) anchored to the floor with (for example concrete anchors (3) cast in epoxy). However, other known means may be used. The post (2) could also be fixed to a mobile base provided means are used to ensure that the post remains substantially vertical.

30 Two seals in the form of plastic rings (6) are installed on top and bottom of the counterweight to (5) prevent friction between the piston/counterweight (5) and the interior of the post (2). They are configured to let air or other gazes leak at a predetermined rate, depending on the need.

A valve (33) allows the control, the inflow of pressurized air stored in a reservoir or generated by a compressor (not shown) within the post (2) under the counterweight (5) so as to lift the counterweight.

5 The predetermined air flow passing through the seal (6) around counterweight (5), a valve (33) or other similar means or a combination thereof allows the control of the outflow the removal of the air under the counterweight (5) so as to allow it to be lowered.

Counterweight (5) preferably has the following characteristics:

10 1. The counterweight also acts as a piston.

2]. Its rising movement is made possible with low air pressure at four pounds per square inches (4PSI).

15 {2} [3]. The sealing principle of the counterweight (piston) is to use air friction when it is moved through a small {crack} opening. This principle allows the creation of air pressure below the piston using very little air.

20 {3} [4]. Another advantage with this principle is the fact that the small air leak created causes the piston to stay {perfectly} centered in the tube and eliminates {wearing effect.} [the wearing effect between the counterweight (5) and the interior of the post (2).]

25 {4} [5]. Along with insuring guiding and sealing, the use of this leaking system eliminates the need to pressurize the top of the piston or the use of [an] air exhaust valve. This system requires only the reduction or closing of the air intake to allow the counterweight to lower simply by gravity thus {rising the object.} [raising the object.]

30 {5. It is impossible to abuse or break this equipment due to the fact that it can only lift 99% of

the counterweight. Friction of mechanical elements is the reason for the 1% loss.

6. Using the supporting post as the compression chamber allows 360 degree continuous movement.

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7. The closeness of the pulleys supporting the carriage system produce a breaking effect in the event the operator would try to rise too high the counterweight.

8. The counterweight can be of variable weight:

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It is a container} [The counterweight may be of variable weights. In such a case, it may be] equipped with a trap [or other known means] on the bottom that allows rapid emptying. {

15 }This container is [preferably] open on top. A tank installed on top of the {equipment} [apparatus] can be filled with granular material or liquid using quiet moments. A trap [or other known means] on its bottom is used to fill the counterweight container as required.

The {method of bringing} granular material or liquid can be {achieved} [raised to the tank] by using a $\frac{1}{4}$ HP small conveyor system with {jars} [buckets] in a continuous movement.

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Management of the counterweight can be made possible by using liquids (water, oil, mercury) or granular material (sand, steel balls, polymeric balls). {

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}If mercury is chosen, everything must be done in closed circuit in order to avoid possible environment contamination. It must be noted that mercury has the advantage of being very compact {although extremely expensive.} [although extremely expensive.]

A piece of rubber (7) bolted or otherwise attached to the bottom of the counterweight eliminates impacts when lowering.

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OPERATION

5 This equipment is a lifting arm allowing easy handling of any solid object which can be held by a suction disc, a magnet, a hook or any other holding system. When a 12 foot arm is used, the operator can handle the object within a diameter of 24 feet and controls the lifting and lowering by a remote control either wireless or connected. The stand on which the remote control is installed is also preferably used as a handle for the operator at the base of the holding system. The holding system can be of any applicable shape.

10 Using a melamine-coated sheet as an example, the operator inserts air under the counterweight. As a result, the holding system (in this case the suction disk) lowers on top of the sheet. Once the sheet is appropriately held, he/she releases the air and the counterweight is allowed to lower with the effect of gravity thus lifting the sheet. The operator can then move the sheet where required and reinsert air under the counterweight to force it to raise thus lowering the sheet. Finally, he/she
15 releases the sheet and is ready for another manoeuver.

20 The equipment shown in the figures is designed to handle small charges varying from 50 to 150 lbs. However, it is possible to build an apparatus to lift heavier loads by making the necessary changes to the counterweight and insuring that the other components are properly sized.

25 A counterweight (5) which also acts as a piston is placed inside the vertical post (2). The piston (5) may move up and down, preferably under pressure created by a gas underneath the piston. It is also possible to use a variable weight counterweight (5). For example a container having an open topside and a valve or tray on its underside. A fluid such as a liquid, or a granular substance and preferably within such elements as synthetic or natural oil, mercury, water, sand, metal, glass or polymer beads, etc... may be introduced in the container to create the required mass.

30 The aforementioned piston (5) being firmly held by a cable (29) to the carriage (50) moving in or on the lateral arm (38) and forcing the attachment system (30) to remain at the same distance from the carriage (50) no matter its position on the arm (38).

Although a preferred embodiment of the invention has been described in detail herein and illustrated in the accompanying figures, it is to be understood that the invention is not limited to this precise embodiment and that various changes and modifications may be effected therein without departing from the scope or spirit of the present invention.

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Claims:

1 1. System for lifting and moving an object from one point to another, said system comprising :

5 a. a partially hollow vertical post;
 b. a counterweight disposed within said post;
 c. first means allowing the counterweight to move vertically;
 d. a lateral arm pivotally held to said vertical post and comprising a first proximal end located near said post and a second distal end located away from said post;
10 e. a cable having one end attached to said counterweight and the other end attached to said distal end of the lateral arm;
 f. a carriage supporting said cable;
 g. second means allowing the longitudinal displacement of the carriage along said lateral arm; and
15 h. means to support said load attached to said cable.

2 2. A system as described in claim 1 comprising one or more longitudinal supports moveably connected to said post and fixed to said lateral arm.

20 3. A system as claimed in claim 1 wherein said first proximal end of said lateral arm is held to the post by means allowing it to pivot around the vertical axis of said post.

4. System as claimed in claim 1 wherein said lateral arm can pivot 300° around said post in a continuous movement.

25 5. System as claimed in claim 1 wherein said counterweight also constitutes a piston and said first displacement means comprise a pressurized or compressed fluid.

6. System as claimed in claim 1 wherein said post is used as a compression chamber.

7. System as claimed in claim 6 wherein the pressure in said compression chamber is about four pounds per square inch (4 PSI).

5 8. System as claimed in claim 5 wherein said first displacement means comprise pressurized air.

9. System as claimed in claim 8 wherein the air pressure in said post is about four pounds per square inch (4 PSI).

10 10. System as claimed in claim 1 wherein the counterweight is also a piston comprising sealing means between the piston and the post and the first displacement means comprise pressured air in the portion of the post located under the piston.

15 11. System as claimed in claim 10 wherein said sealing means comprise an opening having a predetermined area allowing air to escape there through.

12. System as claimed in claim 1 wherein said first displacement means comprise a liquid.

20 13. System as claimed in claim 12 wherein said first displacement means comprise water.

14. System as claimed in claim 12 wherein said first displacement means comprise mercury.

15. System as claimed in claim 12 wherein said first displacement means comprise oil.

25 16. System as claimed in claim 1 wherein said counterweight comprises a cavity within which a granular substance can be placed thus allowing a variation in the mass of said counterweight.

17. System as claimed in claim 16 comprising means to control the quantity of granular substance placed in the counterweight.

18. System as claimed in claim 17 wherein said control means comprise a trap or valve on the underside of said counterweight.

19. System as claimed in claim 17 wherein said control means comprise a trap or valve on the underside of said counterweight and an opening on the topside of the counterweight.

10 20. System as described in claim 17 wherein said control means comprise a trap or valve on the underside of the counterweight and an opening on the topside of the counterweight and means to lift the granular substance above said post in a reservoir also equipped with a trap or valve on its underside thus allowing the counterweight to 15 be filled.

21. System as described in claim 20 wherein said lifting means comprise a vertical conveyor.

20 22. System as described in claim 17 wherein said first displacement means comprise sand.

23. System as described in claim 17 wherein said first displacement means comprise metal granules.

25 24. System as described in claim 17 wherein said first displacement means comprise metal beads.

25. System as described in claim 17 wherein said first displacement means comprise polymer beads.

26. System as claimed in claim 1 wherein said lateral arm comprises a rail on which said carriage is placed.

5 27. System as claimed in claim 1 in which said carriage is provided with means allowing the carriage to move along said rail and allowing said supporting means to remain at a constant distance from said carriage no matter its position on said lateral arm.

10 28. System as claimed in claim 27 in which said second displaceable means comprise a plurality of pulleys.

29. Carriage for use with a system to displace a load, comprising a cable and a rail itself comprising a first surface and a second surface said carriage comprising:

15 a. a first wheel attached to a first axis which is perpendicular to the direction of the displacement, said wheel being disposed at the longitudinal center of the carriage and being adapted to roll on said first surface;

20 b. a second wheel attached to a second axis which is an extension of said first axis, said wheel being adapted to roll on said second surface.

30. Carriage as claimed in claim 29 in which said first axis and said second axis are unitary.

25 31. Carriage as claimed in claim 29 comprising a first pulley and a second pulley which are parallel to said first wheel and said second wheel.

32. Lateral arm for use with a system to displace a load comprising a cable and an attachment block, a carriage and a post around which said lateral arm can pivot, said arm comprising:

- a. a rail comprising two parallel surfaces separated by a space on which surfaces said carriage can be displaced along the longitudinal axis of said arm;
- 5 b. a vertical support extending downwardly from said rail and being generally parallel to said post;
- 10 c. first diagonal support means extending between said vertical support and a first side of said rail;
- d. second support means extending between said vertical support and a second side of said rail;
- e. means attached to said vertical support allowing it to pivot around said post.

15 33. Lateral arm as claimed in claim 32 in which said first diagonal support means and second diagonal support means are parallel.

34. Lateral arm as claimed in claim 32 wherein said pivot means comprise a pair of bearings displaceable along the exterior surface of the post.]

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Abstract

A system for lifting and moving an object comprising a vertical post [(2)], having a lifting arm [(38)] pivotably mounted thereon. Said vertical post comprising a piston [(5)] connected to a carriage [(50)] slidably mounted on said lifting arm, such that operation of said piston can 5 lower and raise said {charge} [object].